Rhythmic production in Schizophrenia: Time and Force

H. WILQUIN\(^1\), A. AMELLER\(^2\), Y. DELEVoyE-Turrell\(^3,2\), P. THOMAS\(^4\), A. WING\(^3\)

\(^1\) Labo. URECA, UFR Psychologie, Univ. Lille3, 59653 Villeneuve d'Ascq, France
\(^2\) CNRS FRE2726, Univ. Lille2, Clinique FONTAN, CHRU Lille, France
\(^3\) SyMoN, Psychology Department, Birmingham University, Edgbaston, UK

ABSTRACT

Introduction: Patients with schizophrenia are impaired in the fluent execution of action sequences. The aim here was to assess whether these deficits might be due to a problem in the timing of action, or rather in the more complex problem of integrating information from multiple sources.

Methods & results: The subjects’ task was to squeeze a load cell in its centre in order to produce force pulses that were synchronised with each tone, that were presented with equal time intervals (600 ms) or alternating time intervals (400/800ms), with either equal force levels (12N) or alternating force levels (10/14N). To assess the influence on performance of self versus external pacing, each trial was constituted of a 12s period of synchronisation followed by a 24s period of continuation.

Conclusion: These preliminary results suggest that schizophrenia is characterised by a timing deficit, particularly when subjects are to act upon information that is presented in an internal representation of the rhythm to produce (i.e., during continuation). Results were similar for equal and alternating force levels, which suggests that fluency deficits in schizophrenia is not a problem in integration but rather a problem in the timing of multiple elements of a sequence. It would be interesting in future studies to investigate the role of dopamine as it is known to play an important role in the control of the internal clock.

INTRODUCTION

Motor deficits have been described in schizophrenia since the very first clinical observations of the disease in the early 1900s (Kraepelin, 1918). Common and disabling symptoms in patients with schizophrenia, these deficits have enormous impact on the long-term outcome of the disease by affecting work performance and daily functioning. And yet, the exact nature and causes of motor dyscoordination in schizophrenia are still largely unknown.

Andreasen (1990) in a neurodevelopmental model of schizophrenia where he uses the term of “Cognitive Dysetria” to to define the idea of an integration problem of the cortico-othersensilial circuit, that would lead to problems in the fluent execution of cognitive and motor actions in schizophrenia. The dysetria hypothesis is furthermore interesting for its possible clinical explanation of behavioral disorganization.

During object manipulation, patients with schizophrenia scale finger forces both to texture and mass (Delevoye-Turrell et al., 2000), but excessive and uncorrelated high force levels are developed (Vrtunski et al, 1989; Neumann and Wallace 1999; Calipari and Liley 1994). Recent work suggests that this problem of force efficiency may arise only when action sequencing is required (Delevoye-Turrell et al., 2003).

The fluent sequencing of action requires timing of the different elements of the sequence as well as the integration of the information pertaining to time and force. The aim of our study was to assess whether the fluency problem in action sequencing is due to a problem in rhythm production. Our protocol gave the patients a chance to maintain a pure timing problem from the more complex task of integrating time with force.

DISCUSSION

Patients with schizophrenia were impaired compared to healthy controls in the production of both equal and time intervals. Interestingly, the pattern of deficit was similar whether participants were required to produce equal or alternating pulses/Intervals.

Healthy controls produced the time intervals with relatively small errors and had the tendency to increase the intervals. Patients systematically produced shorter time intervals than required. This underestimation of the time interval was similar for equal and alternating force intervals. This is agreement with results presented in the literature (Wahi et al. 1980).

Deficits in the production of time intervals in the patients with schizophrenia were similar whether the force pulse was equal or alternating. These are the first results suggesting that the timing problem in schizophrenia may not be a problem in force and time integration but may be a fundamental problem in timing internal and external events together.

Finally, the most interesting result reported here is the fact that in absence of an external trigger, patients significantly accelerated, i.e. the time intervals were even more shorter compared to that observed during synchronisation (fig. 2, top). This finding suggests a problem in schizophrenia to coordinate and use an internal representation of a target goal. In the synchronisation condition, patients are able to compensate the problem by using the external trigger that is provided here; on each trial patients can readjust in function of the environment. In the continuation condition, however, no re-adaptation is possible and hence, the acceleration of time cannot be compensated. This pattern of acceleration was more or less observed in all patients, even in those that were not included in the statistical analysis because not able to produce the correct rhythm.

Bibliography